



Energy research Centre of the Netherlands

When and How to Decarbonize the Transport Sector?

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Problem definition

- Increasing global primary energy use
 - US 320 GJ/cap
 - Europe 140 GJ/cap
 - China 25 GJ/cap 1980, 75 GJ/cap 2010
 - India 12 GJ/cap 1980, 25 GJ/cap 2010
- Increasing fossil fuel use leads to increasing CO₂ emissions

Problem definition (2)

- Increasing average global temperature
- Stabilisation of temperature increase of 2°C, radiative forcing target of 2.6 W/m²
 - net irradiance between different layers of the atmosphere
 - Positive radiative forcing: global warming
- How and when to reduce emissions?
- How to analyse this? → Integrated Assessment models

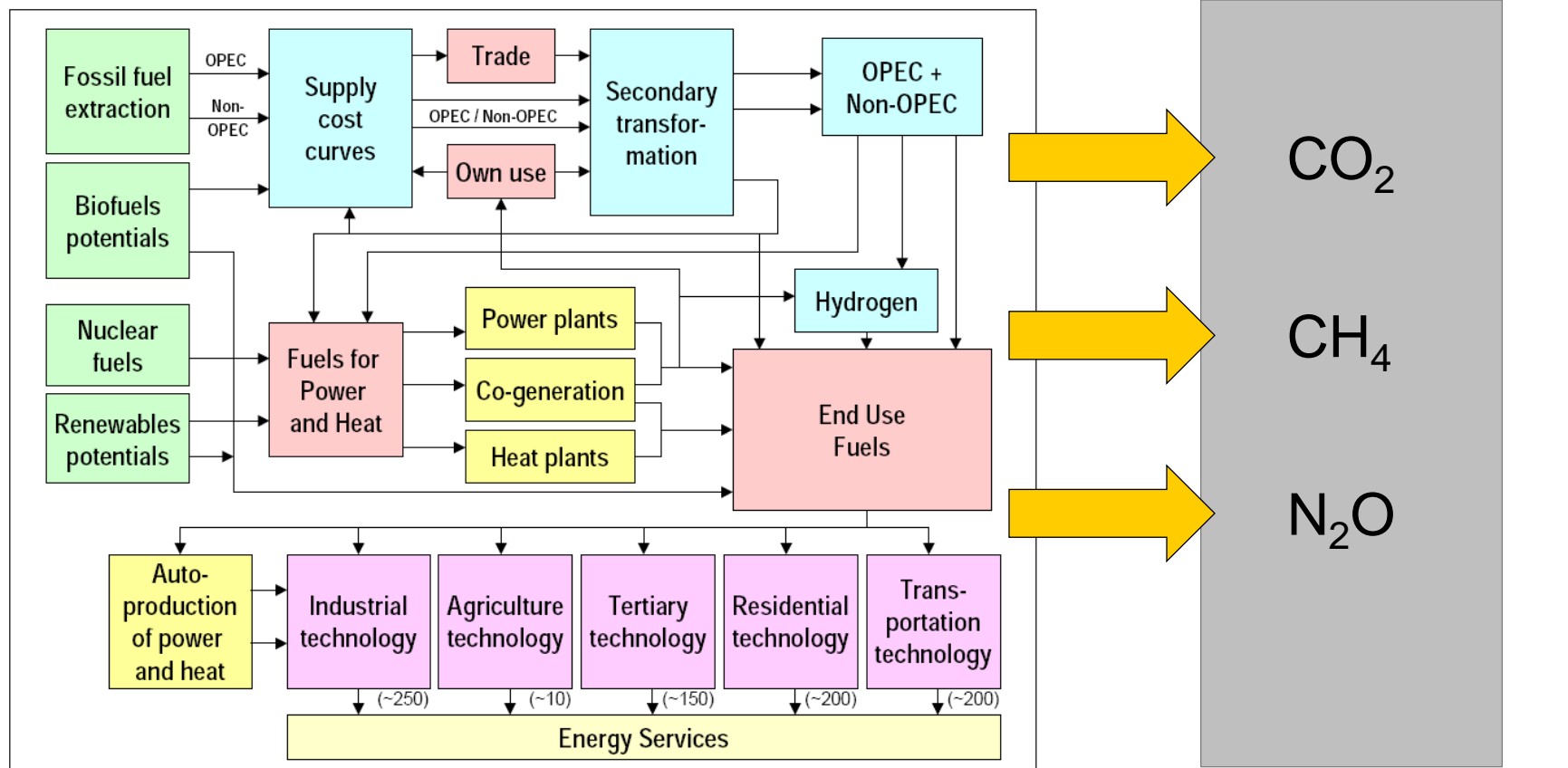
Study set-up

- Baseline
- Reduce emission:
 - global radiative forcing target of 4.0 W/m^2
 - EU emissions reduction targets
- Focus on transport sector
- TIAM-ECN model

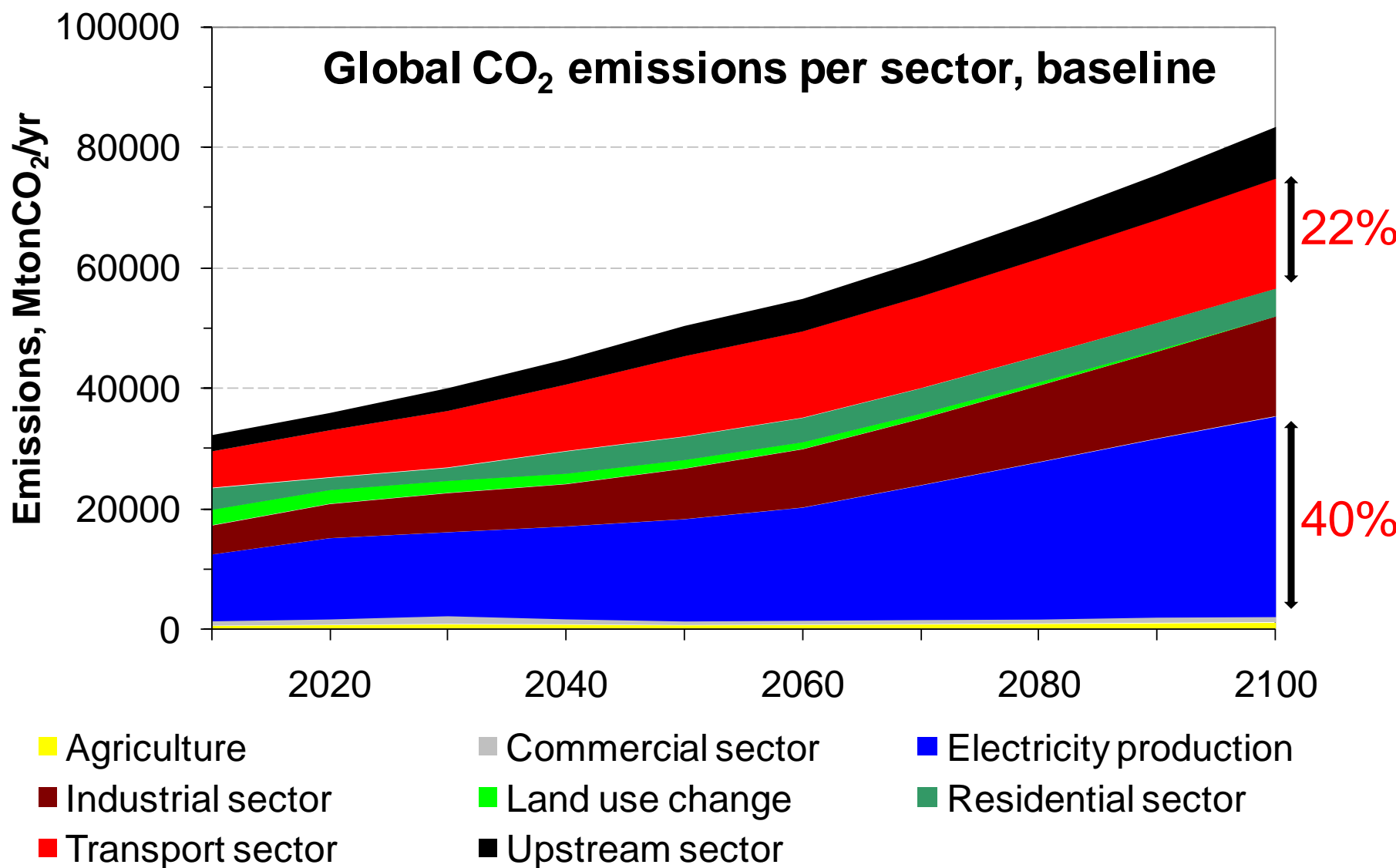
TIAM, overview

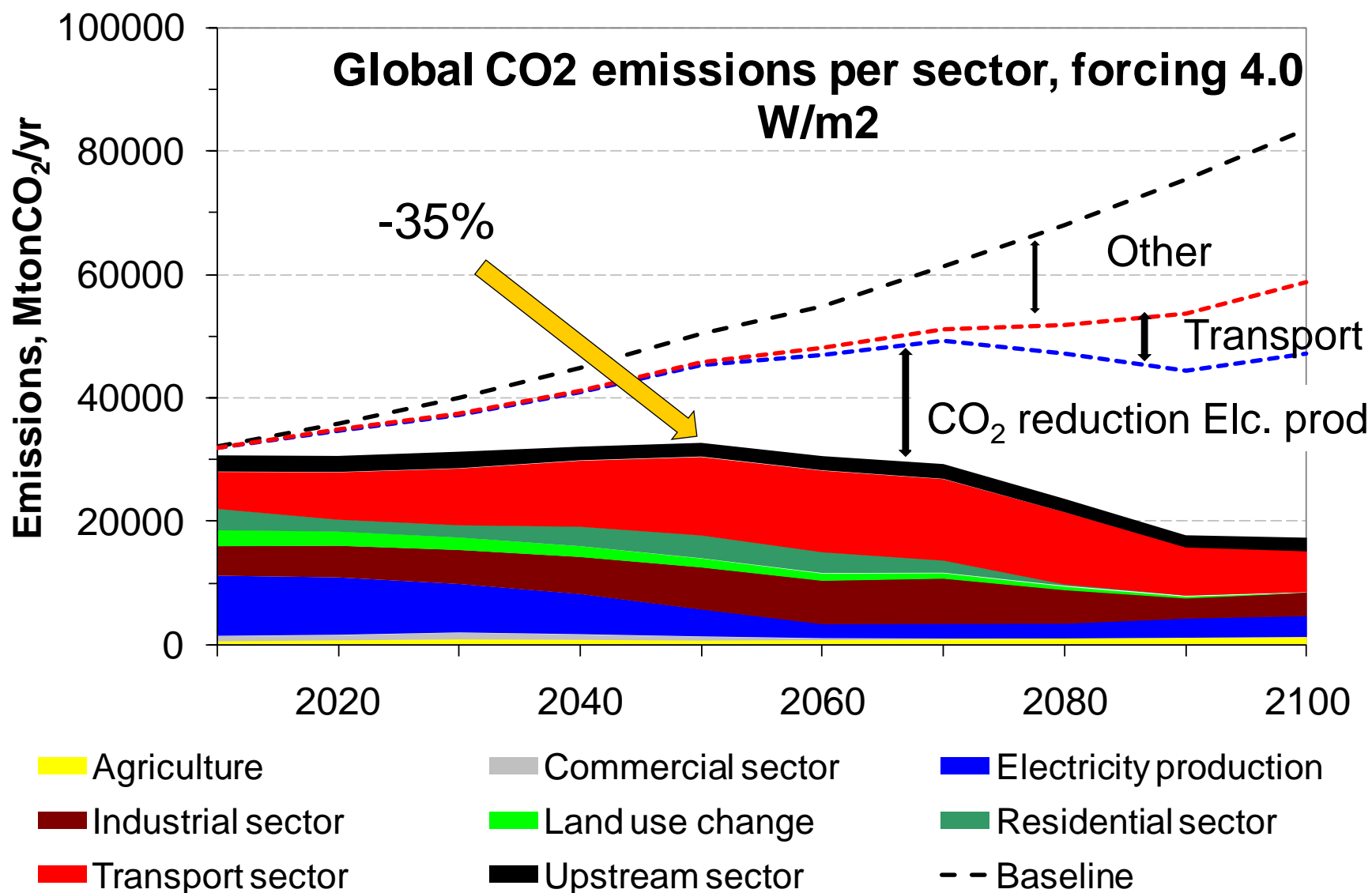
- Global, technology rich, long term energy system model
 - Time frame from 2005 to 2100
 - World divided into 15 regions
 - Calibrated for 2005 statistics
- Describes energy system from resource extraction to the final end use of energy
- Very detailed technology description; includes thousands of technologies
- Main sectors
 - End use demands and their drivers
 - Energy conversion and trade
 - Resources
 - Emissions & Climate

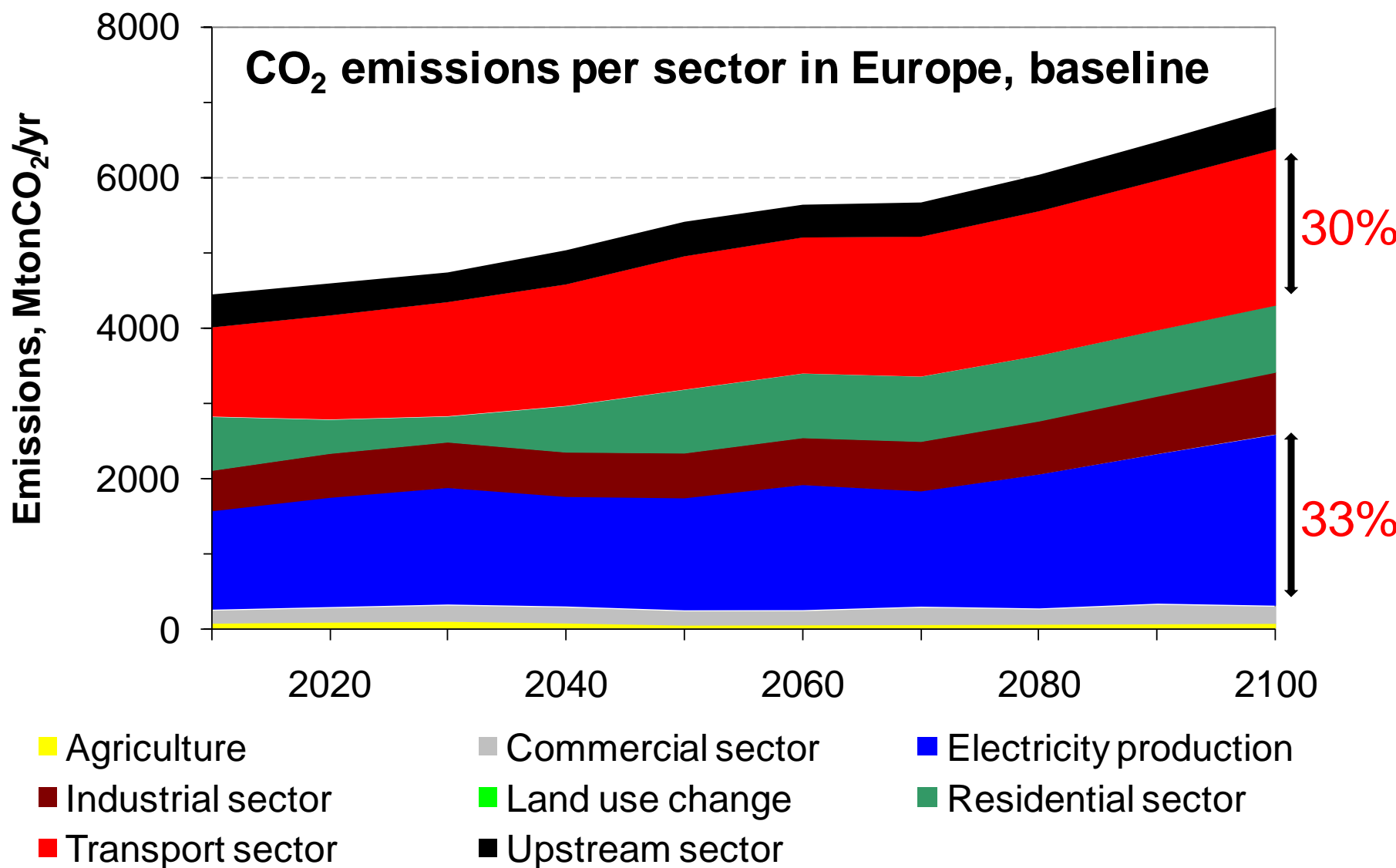
The energy system in TIAM

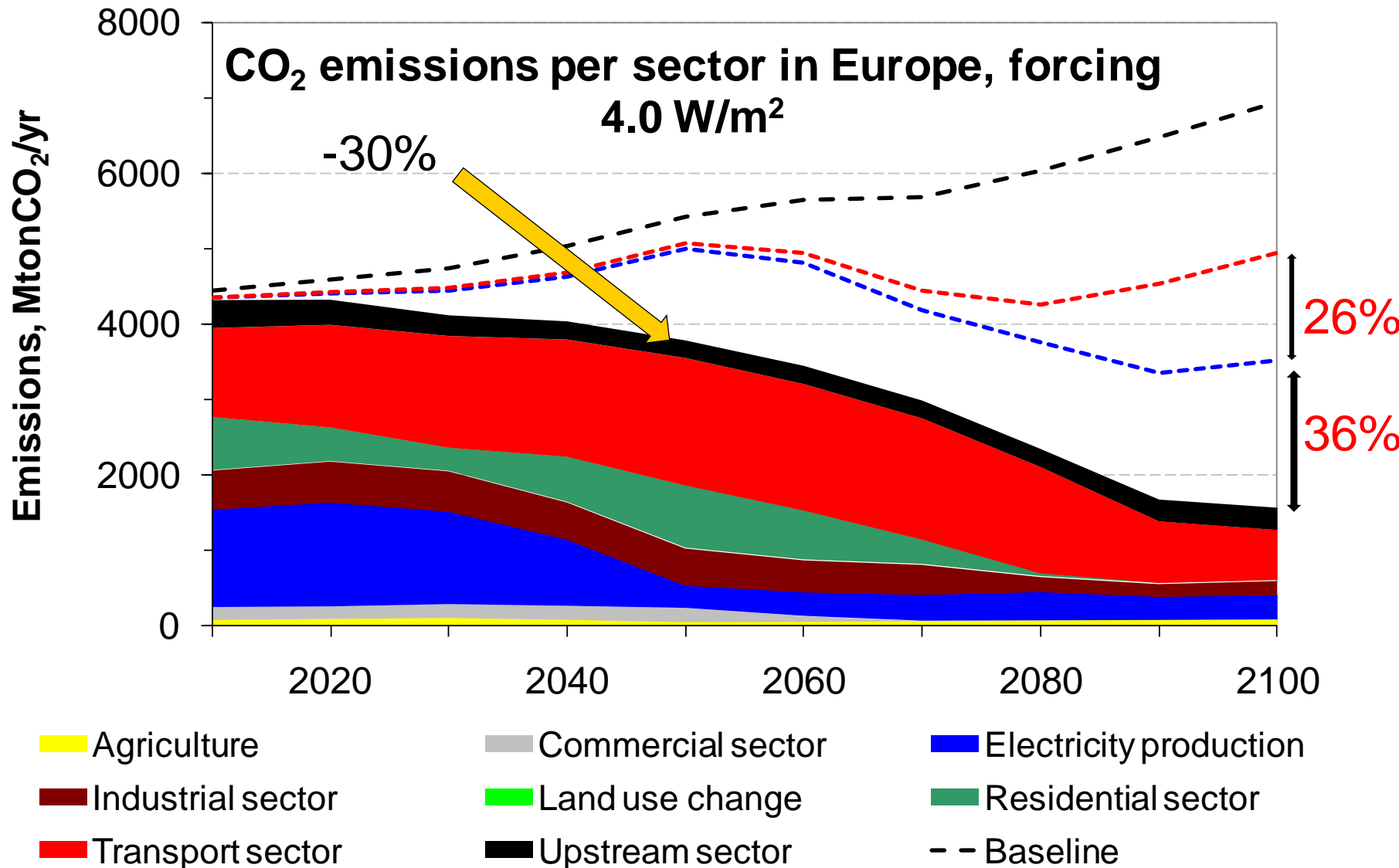


Source: Syri et al, 2007



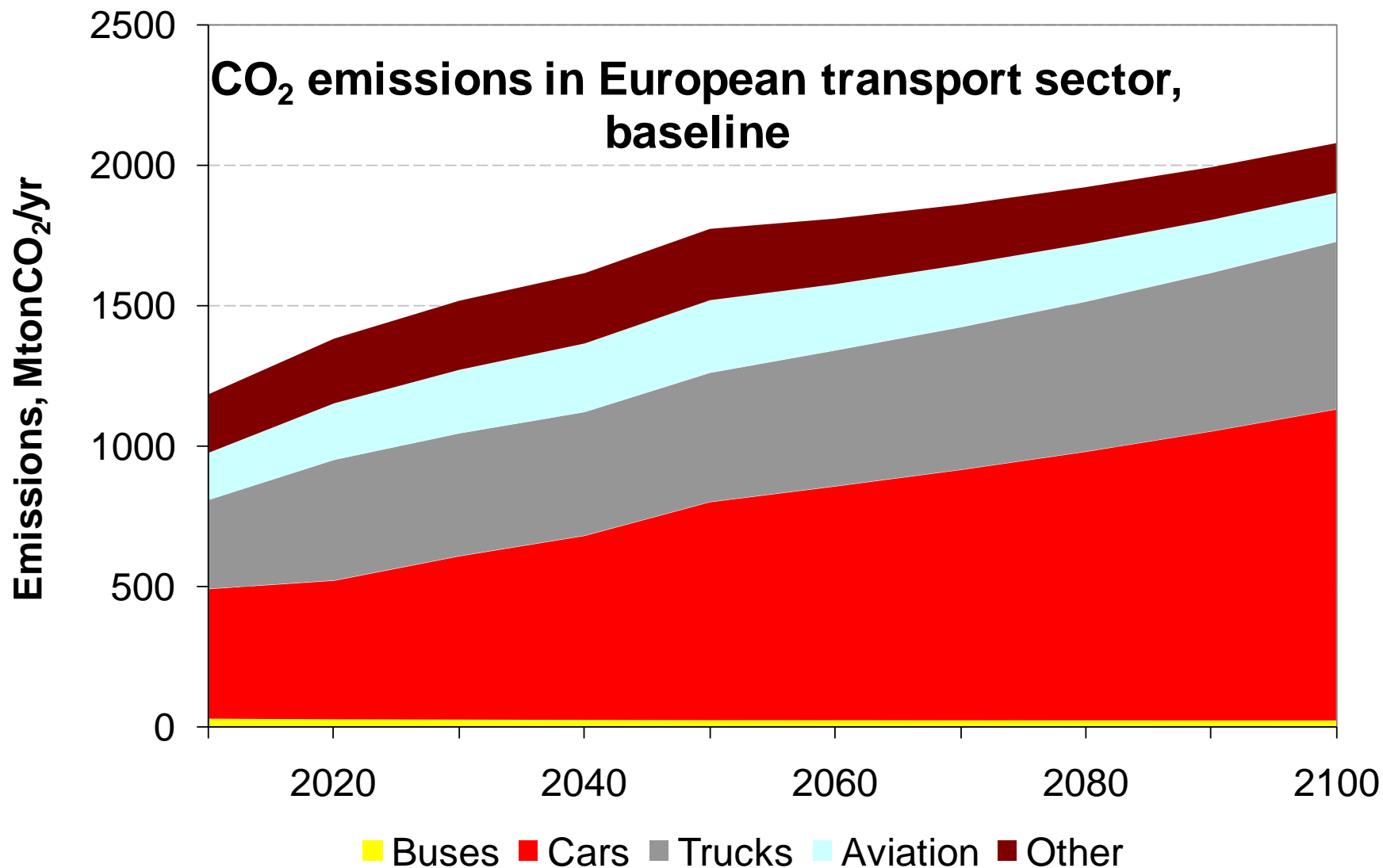


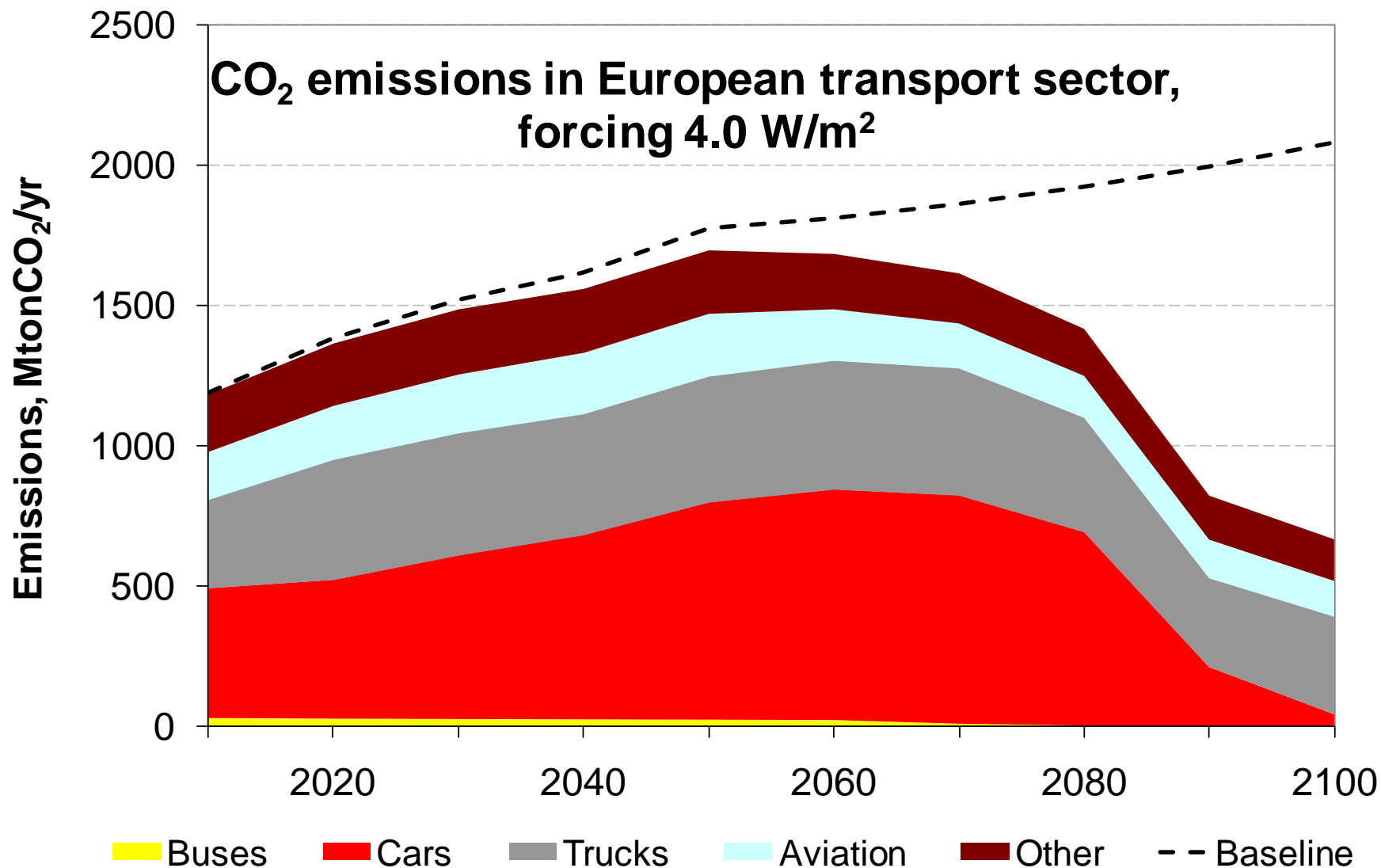


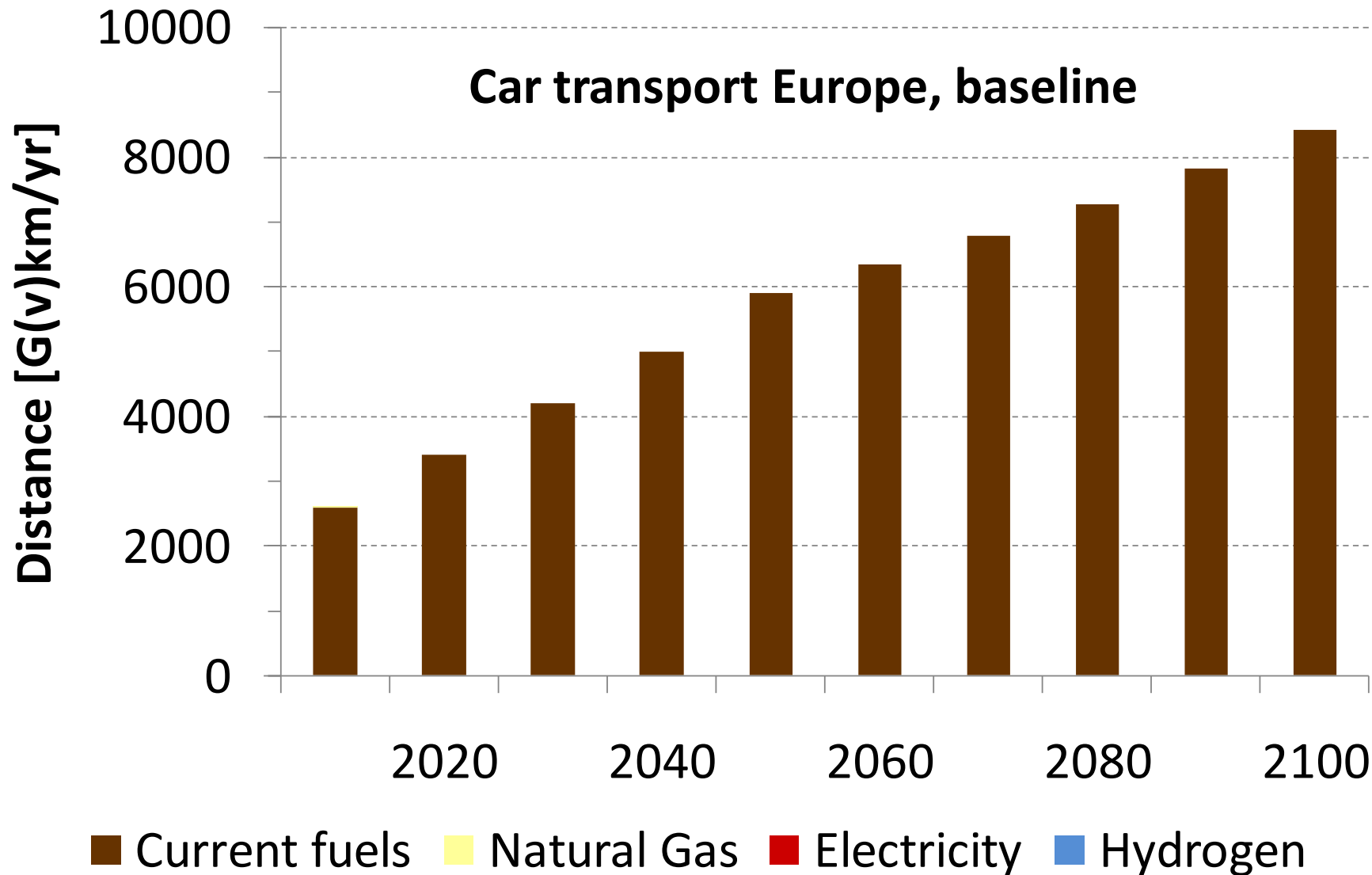


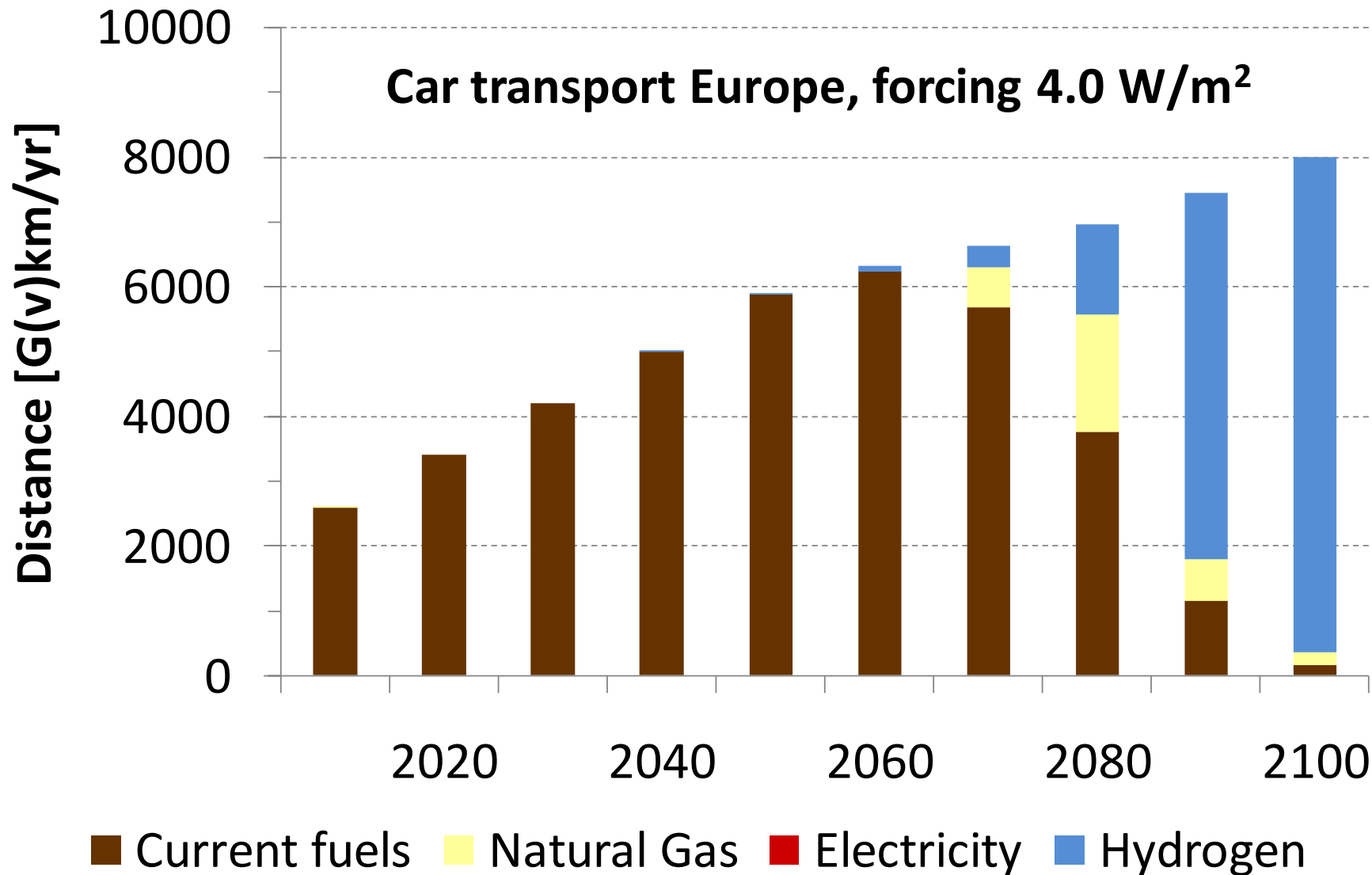
Conclusions

- CO₂ reduction preferable in power sector
- Postpone reduction in transport sector to after 2050





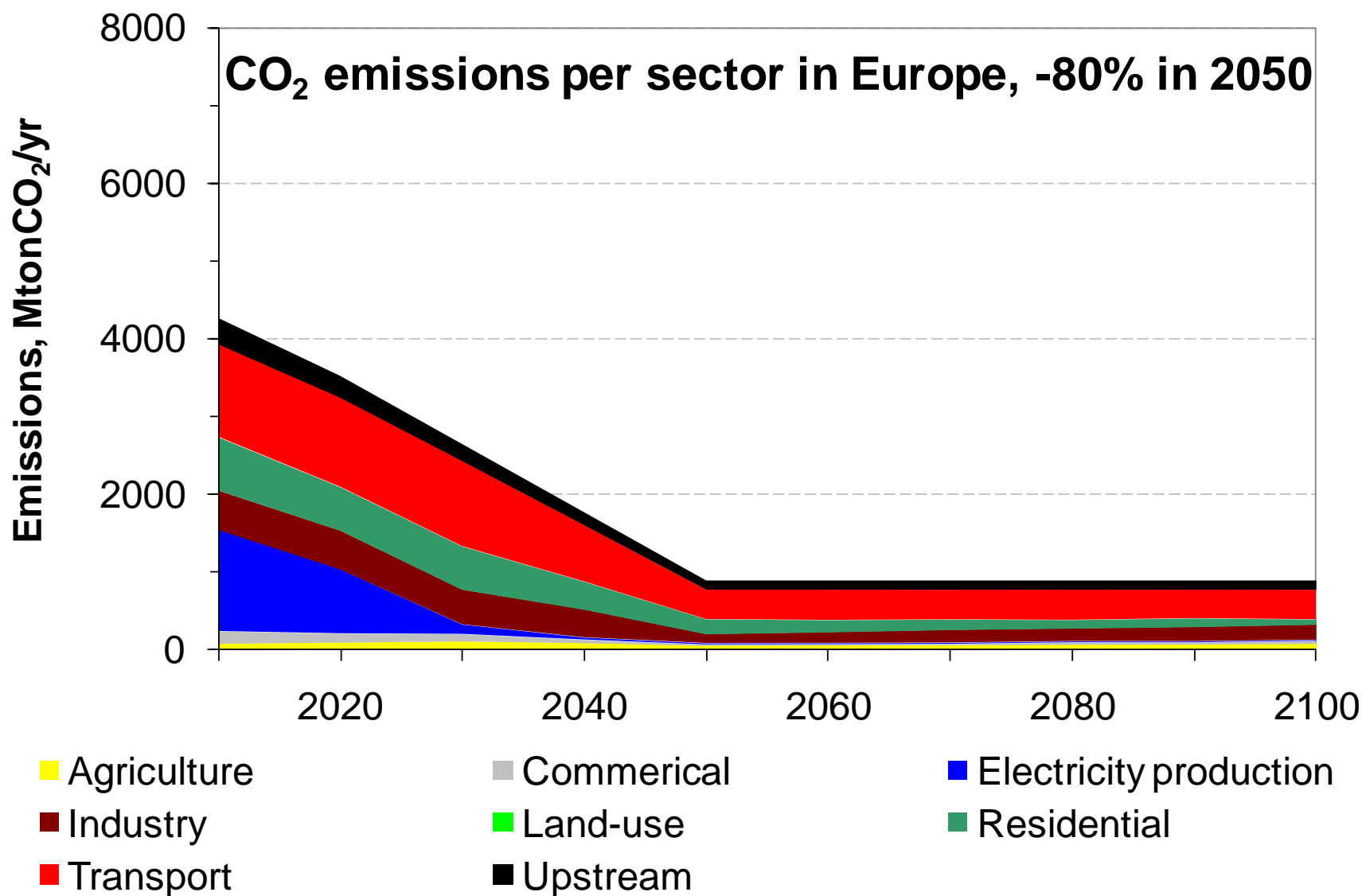


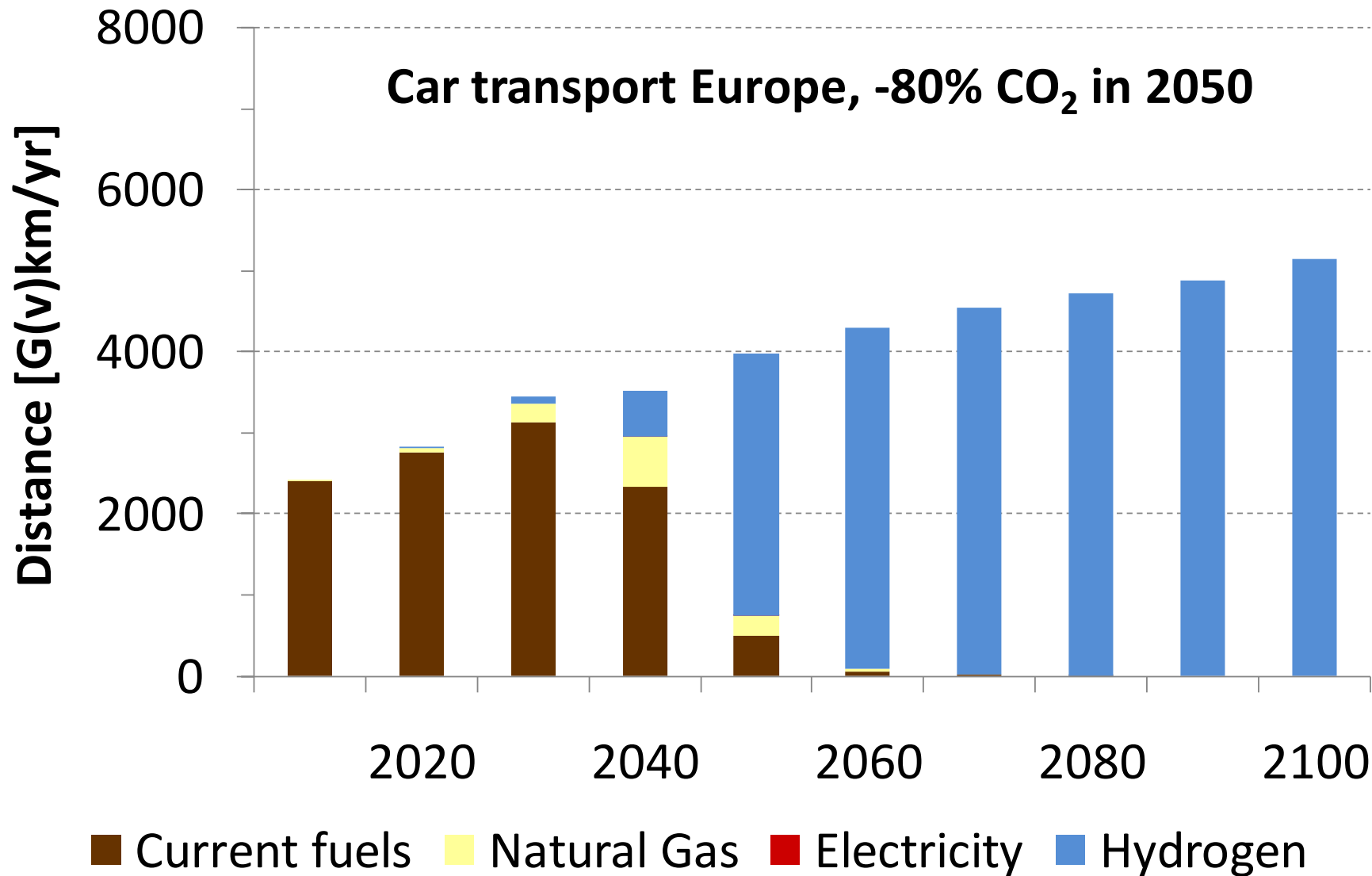


Conclusions

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- Postpone reduction in transport sector to after 2050
- Most reduction transport sector in passenger car transportation
- Hydrogen vehicles the economically preferred option

EU has much higher ambitions: -80% in 2050



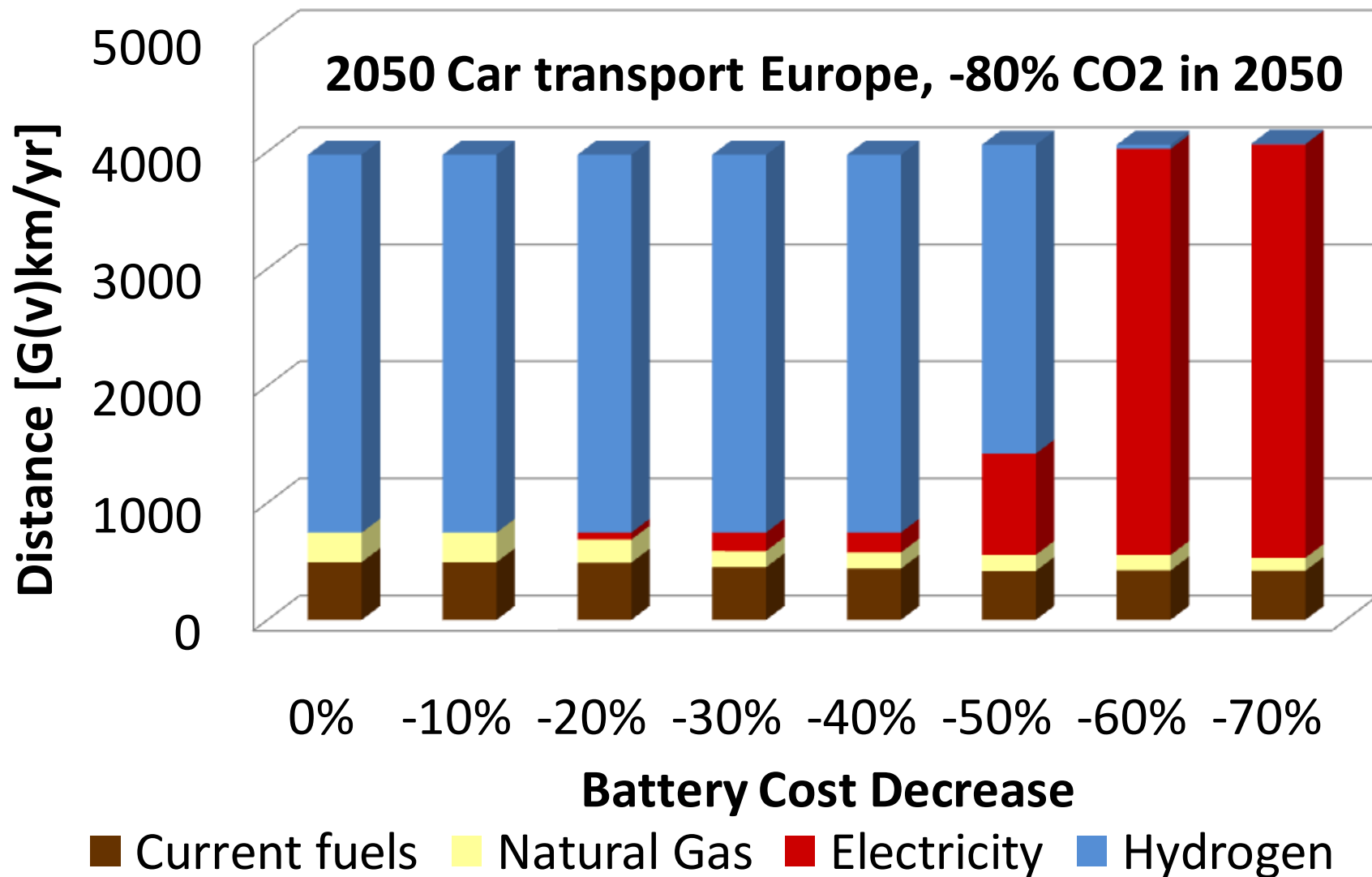


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Why no electric vehicles?

- Battery also in future too expensive.
- Vary battery cost:
 - Basic cost decline between 2020 – 2040 75%
 - 10%, 20%, etc lower costs in 2040



Conclusions

- CO₂ reductions preferable in power sector
- Postpone reductions in transport sector
- Most reductions transport sector in passenger car transportation
- Hydrogen vehicles economically preferable
- Electric vehicles will become economical if costs will be more than 50% less in long term then now foreseen

References (not published yet):

When and How to Decarbonize the Transport Sector?

B.C.C. van der Zwaan, I.J. Keppo and F. Johnsson

A Tale of Two Transport Modes: Hydrogen and Electricity

H. Rösler, B.C.C. van der Zwaan, I.J. Keppo and J.J.C. Bruggink

Regions of TIAM

